

PATENT

Attorney Docket No.: AMAT/6339/CMP/CMP/RKK

Express Mail No. EL913563591US

WHAT IS CLAIMED IS:

1. A method for detecting a polishing endpoint, comprising:
providing a cell body defining an electrolyte-containing volume, wherein the electrolyte-containing volume contains at least electrolyte;
positioning a substrate in contact with a polishing pad at least partially submersed in the electrolyte;
electropolishing one or more conductive materials on the substrate; and
detecting the polishing endpoint of the electropolishing.
2. The method of claim 1, further comprising causing relative motion between the substrate and the pad during the electropolishing.
3. The method of claim 1, wherein electropolishing comprises removing at least a portion of the one or more conductive materials by electrochemical activity.
4. The method of claim 1, wherein electropolishing comprises delivering an electrical signal through the electrolyte between a first electrode and a second electrode, wherein only the first electrode is positionable in direct physical contact with the substrate.
5. The method of claim 1, wherein electropolishing comprises delivering an electrical signal through the electrolyte.
6. The method of claim 5, wherein detecting the polishing endpoint comprises detecting at least one of an increase in a voltage and a decrease in a current of the electrical signal.
7. The method of claim 5, wherein detecting the polishing endpoint comprises monitoring a signal characteristic of the electrical signal.

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8. The method of claim 7, wherein monitoring the signal characteristic of the electrical signal comprises monitoring at least one of a voltage and a current of the electrical signal.
9. A method for detecting a polishing endpoint, comprising:
 - providing a cell body defining an electrolyte-containing volume, wherein the electrolyte-containing volume contains at least electrolyte;
 - positioning a substrate in contact with a polishing pad at least partially submersed in the electrolyte;
 - establishing a potential difference between a first electrode and a second electrode disposed in the electrolyte in order to produce a current through the electrolyte, wherein at least the first electrode is not disposed on a polishing surface of the polishing pad;
 - electropolishing one or more conductive materials on the substrate; and
 - detecting the polishing endpoint of the electropolishing according to at least one of the potential difference and the current.
10. The method of claim 9, wherein the first electrode is disposed on a floor of the cell body below the polishing pad.
11. The method of claim 9, wherein the polishing pad is conductive.
12. The method of claim 9, further comprising continuing to polish the substrate for a period of time after detecting the polishing endpoint.
13. The method of claim 9, further comprising causing relative motion between the substrate and the pad during the electropolishing.
14. The method of claim 9, wherein electropolishing comprises removing at least a portion of the one or more conductive materials by electrochemical activity.

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15. The method of claim 9, wherein detecting the polishing endpoint comprises detecting at least one of an increase in the potential difference and a decrease in the current.

16. The method of claim 9, further comprising initiating a continuing polishing step upon detection of the polishing endpoint.

17. A computer readable medium containing a program which, when executed, performs an operation for detecting a polishing endpoint of an electropolishing process occurring for a substrate in contact with a polishing pad at least partially submersed in the electrolyte, the operation comprising:

detecting the polishing endpoint of the electropolishing according to at least one of a voltage and a current of an electrical signal delivered through at least the electrolyte.

18. The computer readable medium of claim 17, wherein the electropolishing comprises relative motion between the substrate and the pad.

19. The computer readable medium of claim 17, wherein the electropolishing comprises anodic dissolution induced by the electrical signal.

20. The computer readable medium of claim 17, wherein electropolishing comprises removing at least a portion of one or more conductive materials on the substrate by electrochemical activity.

21. The computer readable medium of claim 17, wherein the operation further comprises initiating a continuing polishing step upon detection of the polishing endpoint.

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22. The computer readable medium of claim 17, wherein the operation further comprises changing a voltage value of the electrical signal after detection of a change in a slope of the electrical signal.
23. The computer readable medium of claim 17, wherein program comprises a process recipe comprising a plurality of voltage values for the electrical signal and wherein the operation further comprises selecting the voltage values according to polishing transition points.
24. The computer readable medium of claim 17, wherein the operation further comprises changing a voltage value of the electrical signal after detecting the polishing endpoint.
25. The computer readable medium of claim 17, wherein detecting the polishing endpoint comprises detecting at least one of an increase in the voltage and a decrease in the current of the electrical signal.
26. The computer readable medium of claim 25, wherein monitoring the signal characteristic of the electrical signal comprises monitoring at least one of a voltage and a current of the electrical signal.
27. An electro-chemical mechanical polishing system, comprising:
a cell body defining an electrolyte-containing volume;
a polishing pad disposed in the electrolyte-containing volume;
a power supply configured to supply an electrical signal to electrolyte contained in the electrolyte-containing volume; and
an endpoint detection system configured to monitor a signal characteristic of the electrical signal to detect a polishing endpoint.
28. The system of claim 27, further comprising a reference electrode.

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29. The system of claim 27, wherein the polishing pad is conductive.
30. The system of claim 27, further comprising a controller operably connected to the endpoint detection system and configured to halt a polishing cycle upon detection of the polishing endpoint by the endpoint detection system.
31. The system of claim 27, further comprising a controller operably connected to the endpoint detection system and configured to initiate a continuing polishing step upon detection of the polishing endpoint by the endpoint detection system.
32. The system of claim 27, further comprising a controller operably connected to the endpoint detection system and the power supply and configured to change a voltage value of the electrical signal upon detection of a change in a slope of the electrical signal by the endpoint detection system.
33. The system of claim 27, further comprising a controller operably connected to the endpoint detection system and the power supply and configured to execute a process recipe comprising a plurality of voltage values for the electrical signal, wherein the controller is configured to select the voltage values according to polishing transition points.
34. The system of claim 27, further comprising a controller operably connected to the endpoint detection system and the power supply and configured to change a voltage value of the electrical signal upon detection of the polishing endpoint by the endpoint detection system.
35. The system of claim 27, further comprising an electrolyte container to provide the electrolyte-containing volume with electrolyte.
36. The system of claim 27, wherein the signal characteristic is at least one of a current and a voltage.

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37. The system of claim 27, further comprising:
a first electrode disposed in the electrolyte-containing volume and connected to a first terminal of the power supply; and
a second electrode disposed in the electrolyte-containing volume and connected to a second terminal of the power supply.
38. The system of claim 37, wherein the first electrode is disposed on a wall of the cell body.
39. The system of claim 37, wherein the first electrode is disposed on the pad.
40. The system of claim 39, wherein the second electrode is not disposed on the pad.
41. The system of claim 27, wherein the pad comprises an electrically conductive medium located on a polishing surface of the pad and wherein a first terminal of the power supply is electrically connected to the electrically conductive medium.
42. The system of claim 41, wherein the polishing surface is non-conductive.
43. The system of claim 41, wherein a second terminal of the power supply is electrically connected to an electrode disposed in the electrolyte-containing volume.
44. The system of claim 41, wherein the electrode is not disposed on the pad.
45. The system of claim 27, wherein the endpoint detection system is configured to detect the polishing endpoint according to a change in the signal characteristic.
46. The system of claim 45, wherein the signal characteristic is at least one of a current and a voltage.